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Grinnell Area Petroleum Replacement Initiative, Phase 2

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Abstract
Onfarm creation of bioenergy may not be out of reach of the average small farmer. This project looked at some of the small-scale energy technologies available and assessed their promise for use by small farmers.

Keywords
Bioeconomy and energy, Climate change greenhouse gas emissions, Life Cycle Assessment, Market research and feasibility studies

Disciplines
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Principal Investigator:

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Budget:
$10,500 for year one

Q Can producers in local food systems reduce their emissions and expenses by replacing fossil fuels with "homebrew" biofuels produced on the farm?

MARKETING

A On-farm biofuel production can offer significant opportunities for small farmers to reduce their "carbon footprint" and add value to their produce by partnering with local restaurants and recycling waste oil into biodiesel for on-farm use.

Background

Many farmers have heard about bioenergy (converting plant matter, manure, or wasteproducts into usable fuel to run machinery, provide heat, or generate electricity), but usually the technology is considered beyond the scope of the average small farmer. The Grinnell Area Petroleum Replacement Initiative (GAPRI) Phase 2 was designed to take a closer look at some of the small-scale energy technologies that are currently being used, examine the viability of some of those technologies, and test some of these techniques with farmers willing to build pilot projects.

Phase 2 of GAPRI sought to explore farm-based and rural community-based alternatives to large-scale biofuels production in order to reduce on-farm energy costs and reduce emissions as well as dependence of fossil fuels.

Approach and methods

Strategies for achieving the project goals were to:

1. Identify local farmers to partner with businesses and institutions interested in building a community-based initiative to produce alternatives to corn- and soy-based bio-products;

2. Form a working group to explore resources available, such as biomass sources, feedstock from agricultural waste, restaurant, food production, landscaping, and industrial refuse;

3. Compile information on equipment and processing;

4. Explore the viability of individual on-farm fuel and bio-product production, or formation of a co-op; and

5. Create a work plan, technical specifications, and budget for one or more pilot projects.

Ultimately, several models were developed, and one model, a community-based biodiesel production, was developed as a pilot project.

Homebrew biodiesel setup.

Results and discussion

The project leader and his cooperators were able to construct a reliable, efficient biodiesel processor using open-source technology for under $400, and produce good-quality biodiesel fuel for as little as $1 per gallon, including chemicals and electricity (not including labor). By producing 400 gallons of usable fuel, they were able to reduce the fuel cost of the given operations by approximately $600, breaking even on the initial investment in about four months.

If farmers were to use a homebrew biodiesel in the delivery of produce as well as farming and heating applications, they could significantly reduce the "carbon footprint" of their produce. According to Harvard University's Alternative Fuel Vehicles Program, burning biodiesel emits no sulfur dioxide, 78 percent less life-cycle carbon dioxide, and as much as 50 percent fewer smog-producing compounds than conventional diesel. Net CO_2 emissions from waste-oil biodiesel are hard to estimate, but even when including the production of the methanol, they likely are considerably lower than industrial biodiesel.

Many in the homebrew biodiesel community estimate there can be as much as a 90 percent reduction over petro-based biodiesel, but there do not appear to be definitive studies to back up those claims. Regardless of the exact reduction, produce raised and delivered using homebrew biodiesel could safely be called carbon "climate friendly."

Conclusions

Outreach efforts to farmers, restaurants and institutions were developed and deployed, including a waste-oil collection agreement for restaurants and fact sheets for people interested in producing their own bioenergy. A web site was set up to track the results (see it at www.gotoplanb.net/gapri).

Several workshops and meetings were held with interested parties, and a small biodiesel processor was built. During this period, the project cooperators began picking up waste oil from the Carnforth Inn in Victor, Lonnski's Pub in Grinnell, the food service at the Mayflower retirement community, and recently added Bourbon Street in Grinnell to the project.

The project collaborators successfully produced more than 400 gallons of biodiesel in the latter part of summer 2008 and ran it in blends from b-25 (25 percent biodiesel) up to b-100 (100 percent biodiesel) in Case and Kubota tractors. Both ran trouble-free and without perceptible effect on performance for 10 months.

Impact of results

The investigator brought together a small group of farmers to build and run a processor for producing good-quality motor fuel for use as part of a local food system. This system needed to be efficient, economically viable, and environmentally-friendly. They used a recycled feedstock that was readily available in the community, with a modest equipment budget and an open source technology utilizing off-the-shelf parts.

Samples of raw oil (left), after stripping the glycerin (center, glycerine on the bottom), and washed, finished fuel (right).

In addition to confirming the feasibility of actually building the system, there were other outcomes:

- Strengthening relationships between farmers and businesses,
- Providing an advertising opportunity for the restaurant and farmer as carbon "climate-Friendly Food,"
- Providing potential to reduce expenses and add value,
- Providing community-building opportunities, and
- Increasing access to and awareness of local food and local energy.

Education and outreach

All publications related to the project are available for review at www.gotoplanb.net/gapri/news.html. Among them are: 12 Steps to Collecting Grease, Sample Oil Collection Letter, Titration Manual, Brew Log, and Quality Tests.

Presentations in 2008 and 2009 related to the project included an Introduction to Homebrew Biodiesel at Iowa Valley Community College; two work group meetings at the Grinnell Public Library; an Open Shop-Brew Day; and a speech at the Tallgrass Bioneers Conference.

Leveraged funds

The project obtained a $2,500 Poweshiek Community Association grant for workshop expenses.

***For more information, contact**:*
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